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Estimation of Impurity Content in the Liquid by Minimum Deviation Method Using Hollow Glass Prism

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Abstract: *Impurities are chemical substances inside a confined amount of liquid, gas or solid, which differ from the chemical composition of the material or compound. Impurities are either naturally occurring or may be purposely, accidentally added during synthesis of a chemical or commercial product. A material's level of purity can only be stated as being more or less pure than some other material. This project appeals the use of an optically based method for estimation of impurity in liquid using the dispersion phenomenon of light. We have designed a hollow glass prism to determine the refractive index of any liquid with the help of the minimum deviation method. In this method, we used this hollow glass prism, filled with water and obtained visible light spectrum through minimum deviation method using a spectrometer. We observed that, the refractive index of a solution increased after increasing the concentration of impurity.*

Keywords: Impurities, Hollow Glass Prism

I. INTRODUCTION

Whether in manufacturing, cooking or cleaning, substances are most efficient when they're pure. Purity can be defined as the absence of any impurities or types of matter other than the substance itself. You can use numerous tests to check for purity, ranging from simple visual comparison to sophisticated laboratory techniques. One of the simplest ways to check the purity of any substance is to compare the substance with a certified pure sample. Even physical comparisons can reveal a lot about the purity of a sample. Visual comparison can reveal the presence of any large impurities, such as dirt or other differently colored impurities. If the substance is nontoxic, a smell test can be used to compare it with the pure sample. Any dissimilar odors indicate the presence of at least one impurity. If the substance is edible, a taste test can be conducted. The difference between the taste of the substance and the taste of the pure sample hints at the presence of impurities.

In this project, we are introducing a new method for determining the impurities from the material. This method appeals that lesser amount impurity in material changes its refractive index. This is a very simple method based on optical properties of material. We have used spectrometer to study the light phenomenon (dispersion of light). To work on this idea we have designed hollow glass prism. By using hollow glass prism we measured the change in refractive index of sample by using spectrometer with the help of minimum deviation Method.

II. OBJECTIVES

- To use the hollow glass prism filled with liquid for determination of angle of minimum deviation using spectrometer instrument.
- To study the changes in refractive index of liquid with variation in impurity content, using minimum deviation method.
- To introduce simple, accurate, precise and more sensitive method to determine the percentage of impurity content in water samples.

III. METHODOLOGY

1. Designing of hollow glass prism.

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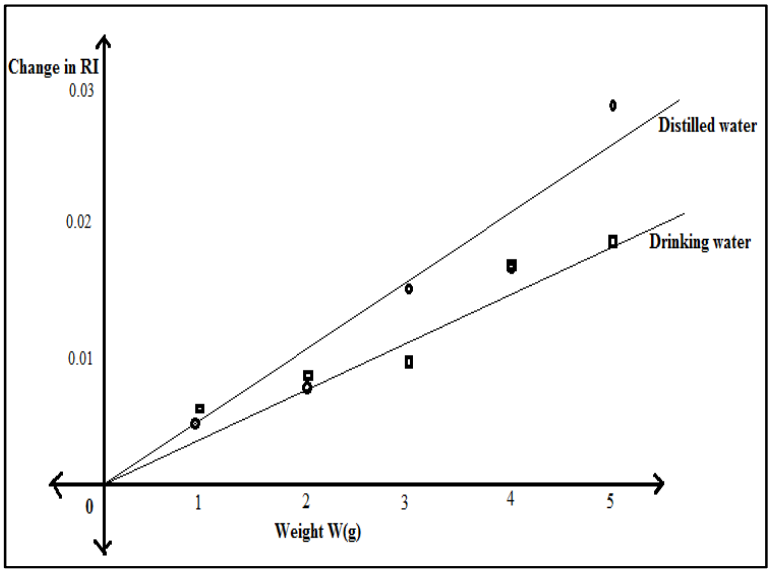
2. Levelling of spectrometer by Schuster's method.
3. Determination of angle of minimum deviation for GREEN spectral region.
4. Calculation of R.I. and change in R.I. w.r.t. sample with no added impurity.
   $\mu=\sin((A+\delta m)/2)/\sin(A/2)$
5. Graphical representation of variation of change in R.I. versus concentration of impurity.
6. Validation of method.

IV. OBSERVATIONS AND CALCULATIONS

FOR DRINKING WATER				
OBS. NO.	**NaCl as impurity added in gram**	**δm**	**μ**	**dμ**
1.	0	21°11'47"	1.3015	0
2.	1	21°34'54"	1.3066	0.0051
3.	2	21°46'43"	1.3092	0.0077
4.	3	21°50'22"	1.3100	0.0085
5.	4	22°33'38"	1.3173	0.0158
6.	5	22°33'42"	1.3195	0.0180

Graph-I



R.I. of distilled water: 1.3467(as reference)

FOR DISTILLED WATER					
OBS. NO.	**Impurity added in gram**	**Change in Refractive Index (dμ)**			
		NaCl	KBr	KCl	KI
1.	1	**0.0045**	**0.0042**	**0.0060**	**0.0087**
2.	2	**0.0072**	**0.0092**	**0.0120**	**0.0169**
3.	3	**0.0146**	**0.0134**	**0.0172**	**0.0233**
4.	4	**0.0160**	**0.0182**	**0.0263**	**0.0330**

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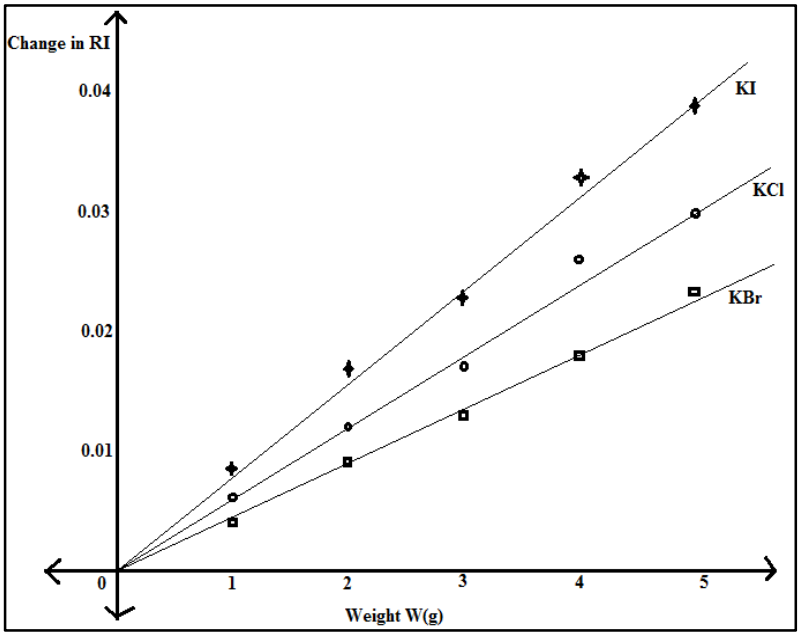
Graph- II



V. RESULT

The calibration curve constructed revealed that change in refractive index is directly proportional to the concentration of impurity i.e. it varies linearly.

VI. CONCLUSION

- This method is valid to optimum level for determination of impurity content in water samples.
- The method developed for impurity determination is found to be easier, accurate, precise and sensitive.

VII. ADVANTAGES

- More sensitive & precise than Density test method.
- User-friendly.
- Can be used for various liquids.
- Cost effective.

VIII. APPLICATIONS

- We can extend this project to find impurities in commercial liquid having optical property.
- For various added impurities, we can design a reference system.

IX. FUTURE ENHANCEMENT

To establish the method as a substitute for Abbe's Refractometer to determine R.I. of liquid samples with optical properties**.**

X. LIMITATIONS

- This method is applicable only when the impurity is soluble in the liquid considered.
- The liquid should possess optical properties**.**

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REFERENCES

[1]. A Text Book Of Optics By: Dr. N. Subrahmanyam, Brijlal, Dr. M. N. Avadhaanulu (S. Chand, 25th Revised Edition 2012 Reprint 2013)
[2]. AJOY GHATAK: OPTICS (5th Edition)
[3]. B.Sc PRACTICAL Physics- Harnam Singh, S. Chand & Co. Ltd. 2001